

REMARKS

File History

In the latest and final Office action of 5/19/2005, the following allowances, rejections, objections, requirements and other actions appear to have been made:

- **Claims 4-10** are indicated to contain allowable subject matter.
- **Claims 1, 3, 13-17, 21-22** were rejected under 35 USC §102 as being fully anticipated by Tsai et al. (US 5,753,418).
- **Claims 1-3, 11-16, 21-26, 34-35, 37** were rejected under 35 USC §103(a) as being obvious over Hui et al. (US 6,514,868) as combined with Tsai.
- **Claims 17-20, 36** were rejected under 35 USC §103(a) as being obvious over Hui et al. (as apparently combined with Tsai and further) as combined with Chien (US Pub. 2002/0142610 of Oct. 3, 2002).
- **Claims 23-26** were rejected under 35 USC §112, paragraph 2 for being unclear.

Telephone Interview of August 9, 2006

In a brief set of telephone exchanges on or before August 9, 2006, the Examiner confirmed that the rejection against Claims 17-20, 36 is indeed based on a combination of three (3) references: Tsai, Hui and Chien.

The Examiner also provided a clearer explanation of his objections to Claim 23. Applicant thanks the Examiner for his patience and courtesy. It is proposed to amend Claim 23 as shown above to address the Examiner's objections.

Summary of Current Response

Claims 4 and 23 are amended.

Arguments and evidence are presented concerning the applied art and its proposed combination and/or modification.

Applicants' Overview of Outstanding Office Action

Applicant sees the final Office action of 5/19/2006 as having the following noteworthy features:

(1) In Tsai '418, there is no ILD or a yet-formed IC active layer. All the layers from pad oxide 12 on the bottom up to ARC layer 16 are sacrificial and are stripped away in the process of forming FOX regions 12a-12b as seen in Fig. 6.

(2) Overlooked in the rejections which propose to combine Tsai with Hui 6,514,868 is that Hui's "reflective" ARC is inorganic silicon nitride and could not serve as an etch mask for Tsai's silicon nitride target layer. Tsai's ARC is "anti-reflective" and thus the antithesis of Hui's "reflective" ARC.

Applicant's Reading of the Tsai '418 reference

Tsai '418 forms the foundation of a majority of the art-based rejections. Co-related to Tsai '418 is Huang 5,837,428 (Ser. No. 08/701,605 which Tsai incorporates at col. 2, line 2). It is well established that references must be read in full for what they fairly teach to one skilled in the art.

The Title of Tsai '418 calls for a 0.3 micron aperture which would dissuade artisans from thinking that Tsai's techniques can be practiced for modern and smaller dimensions. Tsai's scope language at col. 5, lines 44-61 limits the aperture size to "as narrow as about 0.30 microns" (line 54) thus guiding artisans away from considering such a technique for smaller dimensions. (Note that claims 11-12 recite dimensions.)

Referring to Tsai Fig. 6, seen is the end result wherein sacrificial layers 12 (pad oxide), 14 (thermal oxidation mask SiN with negative etch bias, --see col. 2, line 46), 16 (ARC material with superseding positive taper characteristics --see col. 8, line 61) and 18 (photoresist) have all been removed to leave behind only the field-oxide regions (FOX) 12a, 12b and the silicon substrate 10'. At this stage, the silicon substrate 10' has no active device regions in it. (Note that Claim 2 of the present application calls for active regions.)

This argument about no active device regions being present is substantiated in Huang 5,837,428 (Ser. No. 08/701,605) where Fig. 1 thereof shows the same FOX regions 12a, 12b, same silicon substrate 10, but this time with gate oxide 14 provided thereon. It is not until Fig. 5 of Huang '428 that an active device (MOSFET with gate 16a) appears in the process flow.

It is seen from the above that neither of Tsai '418 (applied) and Huang '428 (incorporated by Tsai) teaches or suggests the possibility in sub 0.3 micron technology of positive inward tapering of an ARC being used when patterning an Inter-Layer Dielectric region (ILD) that is to be interposed between first and second conductive layers of a monolithically integrated device.

The preamble of Claim 1 calls for: "forming vias through an interlayer dielectric region of a monolithically integrated device where the interlayer dielectric region (ILD) is structured to separate a first conductive layer from a second conductive layer of the monolithically integrated device, ..." [*Emphasis added.*] (Paragraph (a) of Claim 1 makes antecedent reference to the preamble.)

Tsai '418 teaches away from use of such a method in modern fabrication because Tsai teaches to use his technology only for "as narrow as" 0.3 micron (thus teaching away from narrower) and also because Tsai teaches to completely strip away the thermal oxidation masking layer (SiN layer 14) before any active devices are formed (col. 9, line 63) and to also partially strip away the underlying pad oxide layer 12 (col. 9, line 65). Thus in Tsai there is no interlayer dielectric (ILD) region of a monolithically integrated device.

In the ensuing Huang '428 disclosure (incorporated by Tsai), a negative taper ARC material 18 is used to form a reduced width masking line (18a, 20a' having reduced width W2) as shown in Fig. 3 of Huang '428. Neither of Tsai '418 or Huang '428 suggests the concept of forming reduced contact vias through an ILD.

With regard to Claim 2, it is clear that an active devices layer is not present in Tsai '418.

With regard to Claim 3, there is no factual basis for postulating that CF4 constitutes a source of etch inhibitor which selectively adheres to organic surfaces. Tsai teaches that the ARC material itself is a positive bias one at col. 7, line 32 where the taper angle is in the range 75 to 85 degrees. Tsai does not teach that the etch chemistry should provide selective etch inhibitors.

With regard to Claims 11-12, note that Tsai '418 limits his apertures to as narrow as about 0.30 micron, thus teaching away from the smaller dimensions of Claims 11-12.

With regard to Claims 13-16, the problem is that Tsai has no ILD in which the recited third openings can be formed.

Applicant's Reading of the Hui reference

Hui '868 forms the foundation of art-based §103/102(e) rejections against claims 1-3, 11-16, 21-26, 34-35, 37 and 17-20, 36.

The rational for combining Hui '868 with Tsai '418 is given at OA page 4, lines 7-13 as "Unlike claimed invention, Hui doesn't describe ... organic [anti-reflective] ARC. ... One skilled in the art ... would find it obvious to use any other ARC including organic ... because Hui teaches that the ARC can be any other suitable material having reflective properties" [Emphasis and bracketed text added.]

Note that the original rejection language left out the fact that Hui's ARC is "anti-reflective". Applicant respectfully submits that the above basis of rejection inherently contradicts itself. It admits that Hui calls for ARC's having "reflective properties". That teaching cannot logically cover "all" ARC's since it limits itself to reflective ones. Most especially it cannot logically cover the ARC's of Tsai '418 which are expressly referred to as "organic anti-reflective coating (ARC)" (Abstract, and see also col. 2, line 13). Even a person of less than ordinary skill would appreciate that organic chemistries are different than inorganic chemistries and that anti-reflective ARC's are different than reflective ARC's. Tsai and Hui clearly teach away from one another.

It is well established that references which teach away from one another cannot be combined.

(As an aside, Applicant continues to reserve the right to attack the use of Hui as a prior art reference under the legal fiction of 35 USC §102(e). 102(e) requires a §112 level of description. For example, Hui admits at col. 4, line 30 that the "exemplary" embodiments are preferred ones while not providing any details re recipes and so forth for the supposedly performed examples. Thus there is a question whether Hui satisfies all the requirements of 35 USC §112.)

Re Claim 34, this is for a "contact forming method" including the step of "(d) filling the substantially vertical contact holes with an electrical conductor". Tsai '418 does not teach a contact hole filled with conductor. Tsai teaches an oxidation hole which is replaced by growth of insulative oxide. This is opposite to forming a conductively-filled via.

Re Claim 26, the recited "different plug spacings and/or different spacings between corresponding conductive lines" are not inherent to Hui or Tsai. It is not understood how the PTO can use pages 7-8 of the present application (detailed Description) against Applicant at page 6 of the OA.

Claims 17-20, 36 rejected in view of Tsai '418 combined with Hui and further combined with Chien '610

No rational is given at OA page 6 for combining Hui '868 --first with Tsai '418 as confirmed via telephone by the Examiner-- and then further with Chien '610. As already argued above, Tsai '418 teaches an anti-reflective organic ARC. Hui teaches a reflective inorganic ARC (silicon nitride). Thus they teach away from each other and cannot be fairly combined.

Chien '610 calls for the combination of a silicon nitride etch stop layer (page 1, paragraph [0010]) and a silicon oxide dielectric layer disposed over the etch stop (paragraph [0011]). In Fig. 1A, layer 106 is the SiN etch stop (paragraph [0025]). Layer 114 is the silicon oxide dielectric layer (paragraph [0026]). As seen in Fig. 1C, Chien teaches to retain the insulative silicon nitride 122 over the gate 104 (see paragraph [0025]) so as to thereby provide a contact hole that is smaller at its bottom than at its top. From this, it is seen that Chien teaches a hole tapering technique entirely different from that of Tsai '418. Thus it may be said that Chien and Tsai teach away from one another. Thus we have three references that teach one away from the other: Tsai, Hui and Chien.

The etch recipe that Chien provides at [0041]-[0042] is employed for selective etching of the oxide material (114) in preference over etching of the nitride etch-stop material (122, 106). See Chien paragraph [0038]. In this, Chien teaches away from Tsai '418 because layer 14 of Tsai is silicon nitride and Chien's recipe is formulated specifically to not etch through nitride. Chien also teaches away from Hui because Hui directs the artisan to etch straight through to the substrate 12 whereas Chien teaches to stop at a nitride etch stop layer 106. Chien does not disclose what "subsequent etch" ([0026]) is to be used for removing the silicon nitride in transitioning from Fig. 1B to 1C and thereby achieving the claimed 0.25 micron contact dimension. Thus Chien is non-enabling in this respect.

With regard to arbitrary picking and choosing of etch chemistries, such as is done at OA page 7, paragraph 5, please note that Hui teaches a silicon nitride hard mask with no PR on top. Chien use conventional photoresist (layer 116, see paragraph [0026] and no hard mask on top. The choice of materials to be used in an etch is dependent on the totality of the chemical and energetic plasma environment. A person of skill in the art would not arbitrarily choose any and all chemical compositions in accordance with mere whim. That is not reasonable.

Re claim 36, there is no showing that Chien's etch process generates tapered ARC openings.

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Indefiniteness rejection

An indefiniteness rejection is appropriate when the PTO can demonstrate that a person skilled in the art would have no reasonable way of determining the metes and bounds of the claim.

Applicant thanks the Examiner for explaining his objections to Claim 23. It is believed that the proposed changes to Claim 23 will overcome the Examiner's objection.

Please note that paragraph (e) Claim 23 recites "using a predefined photomask to define width dimensions of the first openings". This clearly makes antecedent reference to the first openings of the first integrated device (the one mentioned in the preamble). It is proposed to clarify paragraph (f) of Claim 23 by reciting "using the same predefined photomask to manufacture additional monolithically integrated devices" [*Emphasis added.*]. This clarifies that a further limitation is that of using the same photomask as used in manufacturing the integrated device of the preamble to manufacture additional integrated devices. Entry is respectfully requested.

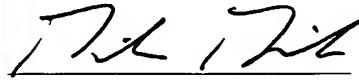
With regard to the actual indefiniteness rejection, it is respectfully submitted that one skilled in the art will not be confused about scope. Either one engages in "using the same predefined photomask to manufacture additional monolithically integrated devices" or not. There is nothing indefinite about that. Either each of the manufactured integrated devices is either one "each having a respective version of said ILD region" or not. There is nothing indefinite about that. Either each of the manufactured devices is one "each having a respective version ... of said photoresist layer" or not. There is nothing indefinite about that. Either each of the manufactured IC is one "each having a respective version ... of said ARC layer with inwardly-tapered openings" or not. There is nothing indefinite about that. Either "at least two of the monolithically integrated devices that are manufactured by use of said same predefined photomask have differently dimensioned widths for their corresponding, third openings" or not. There is nothing indefinite about that. So Applicant fails to see what is indefinite about the claim. Clarification is respectfully requested if the Examiner continues to object to Claim 23.

CONCLUSION

It is believed that all outstanding grounds of rejection have been overcome or traversed in light of the foregoing. Applicant respectfully requests entry of the amendments and reexamination with favorable outcome. Should any other action be contemplated by the Examiner, it is respectfully requested that he/she contact the undersigned at (408) 392-9250 to discuss the application.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 50-2257 for any matter in connection with this response, including any fee for extension of time and/or fee for additional claims, which may be required.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on August 10, 2006.

 8-7-06

Attorney for Applicant(s)

Date of Signature

Respectfully submitted,



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